



June 5, 1970

Attention: John C.

Dear John:

Enclosed for your files are three (3) copies of Activity Summary, ☐ 2201201-AS-6 and three (3) copies of Activity Summary, ☐ 2201201-AS-7. Attached to Activity Summary #7 are working notes, copies of which were left with John C. and Major Hayden P.

25X1

Sincerely,



Senior Staff Scientist

PSC/c
Enclosures

[REDACTED]

June 8, 1970

ACTIVITY SUMMARY

To: John C.
From: [REDACTED]
Subject: Contract Visit to Customer Facility
3, 4 June 1970
Contract [REDACTED]
Reference: [REDACTED]/2201201-AS-7

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[REDACTED] was present at the [REDACTED]
[REDACTED] on June 3,4 to pursue data collection for demonstration
of the initial activation and operation of holographic image
processing. During these two days the filters and smeared
imagery generated the previous week were analyzed. The specifics
of this activity, and the results are described in the program
laboratory notebook.

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There are several points relative to the laboratory facility
that should be cited.

- 1) During the past two visits ([REDACTED] on 25-27 May,
[REDACTED] on 3-4 June) the laser illumination
problem has become acute. Light levels have been
marginal during the past month but are now well
below minimum requirements necessary for laboratory
image processing. It is recommended that a 50 mw
power be available for this facility. Also, laser
radiation in the blue, green and red wavelengths
should be available to allow color image processing
activity. An immediate but temporary solution
to the light level problem can be gained if a 10 to 15mw
laser, at 6328Å, is obtained.

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- 2) The condition of the optical benches is poor due to lack of maintenance. The ways of the Ealing-Tech/Ops optical bench have become rusty and the fine adjustment of components along the ways is impossible. It is necessary to clean and oil the V groove and flat way periodically. This is also necessary for the Beck bench.
- 3) The laboratory area has been especially designed for cleanliness. It is recommended that the facility receive special "housekeeping" emphasis to gain this objective and also to maintain an orderly appearance.

During the past two days several documents were written and are attached to this Activity Summary. They are:

- 1) Frequency response analysis of motion blurred imagery that is being used at the [REDACTED] [REDACTED]
- 2) Projected schedule and manpower requirements for the lab program during the months June - August, 1970. It is important to note that this program includes the contribution of Laboratory personnel as well as [REDACTED] personnel. Any decrease in applied effort by Laboratory personnel will have an impact on the results that can be obtained during this program.

The above two documents were delivered to John C. and Major Hayden P. respectively. A third document was written for John C. for justification of lasers for use in the lab. This document was left with John. It contains recommendations for two lasers with sufficient power in the red, green and blue wavelengths.

No Program Plan was written prior to the end of the working effort on June 4, so a call was made at 10 AM on June 5 and two points brought up for follow through. They are:

- 1) Fabrication of a hologram filter from a 0.5 x 2.5 mm slit for holographic image blur removal.
- 2) Generation of a numeric target for testing the process.

The next trip is scheduled for [] on June 9, 10 and [] on June 11, 12. The objective for this week is to conclude all data collection for the briefing scheduled for the week of July 6, 1970. Following this week we will start work on the Beck optical bench for partially coherent-incoherent image processing activity.

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[]
Senior Staff Scientist

PSC/c
Attachments

Working Notes

25X1

To:

From

Subj. Projected Schedule and
Manpower Requirements for
Image Manipulation Program.

Date 4 June, 1970

25X1

Ref. no. / 2201201 - AS - 8

Working Notes

Optical Image Manipulation Program

The program schedule during the past 6 weeks has involved weekly visits by [redacted] personnel to the

[redacted] This schedule

has been above the projected average for the whole program in order to implement program activity with the holographic system and coherent processor during these initial weeks.

These systems are now functional and demonstrable results are being collected for briefing purposes.

Following this, we will commence image manipulation activity using the Beck optical bench. A normal travel schedule, once every two weeks, is projected. Flexibility will be required so that adjustments in the

schedule can be made for circumstances as they arise.

Projected Schedule

June - August, 1970

Week	Tasks
8 June	Data completion for briefing.
29 June	Briefing preparations. Outline of initial activities for Beck bench.
6 July	Briefing. Final program description for initiation of image manipulation program up to the first milestone.
13 July	Set-up and alignment of optical components on Beck bench. Define any new equipment requirements or modifications (e.g. filter wheel...). Initiate fabrication of first filter set.
27 July	Complete first filter set and requirements for demonstrating the first image manipulation series.
10 August	Initiate system manipulation procedures. Collect data.

24 August Demonstration and recording
of results.

Projected Manpower Requirements[†]

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[redacted] personnel 24 man days

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[redacted]

It is expected that the lab requirements ~~will~~ require a full-time effort of one scientist.

† The above schedule and manpower estimate was made without reference to the proposal and cost status of the program and therefore subject to some inaccuracy.

To John C...

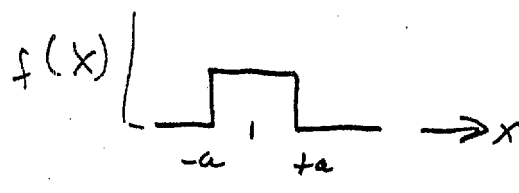
From

Approved For Release 2005/11/21 : CIA-RDP78B05171A000500020017-5

①

Working Notes

Smeared Point Function, width = $2a$



$$R[x/\lambda F] = f(x)$$

$$F(\omega) = \int_{-\infty}^{\infty} R[x/\lambda F] e^{i \frac{2\pi \omega x}{\lambda F}} dx$$

$$= \int_{-a}^{+a} e^{i \frac{2\pi \omega x}{\lambda F}} dx$$

$$= \frac{e^{i \frac{2\pi \omega a}{\lambda F}} - e^{-i \frac{2\pi \omega a}{\lambda F}}}{i \frac{2\pi \omega}{\lambda F}}$$

$$\sin x = \frac{e^{ix} - e^{-ix}}{2i}$$

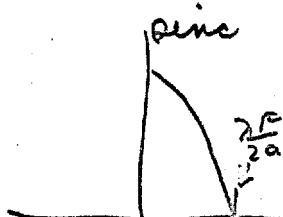
$$F(\omega) = \frac{\sin \frac{2\pi \omega a}{\lambda F}}{\frac{\pi \omega}{\lambda F}}$$

$$= 2a \operatorname{sinc} \frac{2\pi \omega a}{\lambda F}$$

1st zero occurs at

$$\frac{2\pi \omega a}{\lambda F} = \pi$$

$$\omega = \frac{\lambda F}{2a}$$



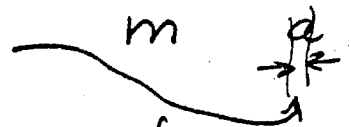
a) smear distance is

$$2a = 0.09'' , \text{Zeros at } 11.1, 22.2, 33.3 \text{ etc } \ell/\text{in.}$$

b) line spacing of lettering $\approx 0.045''$

this corresponds to a line frequency of

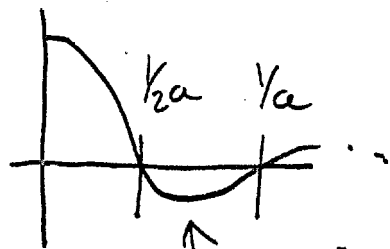
$$\frac{1}{0.045} \ell/\text{in.} = 22.2 \ell/\text{in.}$$



Conclusion

This target is a good illustration of information lost because of the image blur. The print linefreq. occurs at a null of the frequency response.

To use this target as a demo, the blur distance should be altered so that the print spacing frequency is not at a null of the frequency response.



This is

$$\frac{1.5}{2a} = 22.2 \ell/\text{in.} , \frac{1}{2a} = 14.7 \ell/\text{in.}$$

$$2a \approx 0.07 \text{ in.}$$

Student's Name

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Program

25X1

Subject

Instructor's Name

11 Jun 1977

Book 2

A series of numbers were also blurred to the degree previously mentioned. One of the reconstructed numbers is on page 72 of book 1. Other enlargements of smeared and "restored" images are included here.

Blurred Images

Photo here

Photo here

Restored Images

Photo here

Photo here

A polaroid copy of output

Photo here

25X16
12 June 1969

Subject

Instructor's Name

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Notes here omitted because of lack of commiss
of carbon paper during writing!

A program plan was generated to aid the co-op students during the two-week period starting 15 June. The outline included

- (1) Filter fabrication (inverse filter)
- (2) Spectrometry ($\lambda = -2$)
- (3) Laboratory maintenance
- (4) Optical alignment.

These were discussed in the Program Plan handed out on 12 June.

Subject

Beck Bench

Instructor's Name

AM

Talk on the alignment of the Beck Bench

In the past week John has aligned and checked out the Beck bench. Resolution experiments were performed for both the two and three lens system. John found that the three lens system had a higher resolution using a resolution target. The transform plane was not monitored so more work has to be done along these lines.

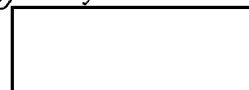
Note: The best system resolution does not always give the best transform. This is a trade off and probably depends on the type of filtering to be done as to which is more important.

Two things should be done on this trip, the first is to look at the transform plane of the Beck bench and the second is to make some DC. filters on high resolution plate

Subject

DC Filter Design

Instructor's Name



1. The first parameter to vary will be the ΔD
To start with densities of (or ΔD 's of.)
1, 2 and 3 will be used.
2. The second parameter will be the diameter or
frequency cut off of the filter.
For a start the following will be chosen
5 ℓ/mm or about 2 mm diameter $r = \omega d f$
4 mm "
6 mm "
8 mm "
3. The third parameter is the shape of the filter.
After consideration the simplest way to define
this parameter is to make some filters on
high resolution plates and trace them on the
microdescribometer.

Subject

Filter making

Instructor's Name

PM

The first filters are being made by the following method:

1. Using a small aperture of $\frac{3}{32}$ " and $\frac{1}{4}$ " and the enlarger, projection printing was done on fine grain positive film. (D-19) 101mm f/4.5 (.1-2 sec.)

2. These were contact printed onto fine grain positive film and developed. (D-19)

In both cases the edges were soft by defocusing.

3. The second generation are light circles with dark background. These will be used as masters for projection printing onto high resolution plates.

DC filter on High Resolution Plates

The remainder of the afternoon will be used to generate filters on High Resolution Plates.

Subject

Instructor's Name

AM

The DC filter made on the 27th will be traced on the microdensitometer.

Micro.D. results

1. High sensitivities can be obtained

$$D \approx 3$$

2. Good gradients (what we consider good) can be obtained by defocusing the aperture being used.

$$\text{Grad.} \approx$$

3. Diameter of filter can be controlled on the enlarger and measured on the microdensitometer.

With these results John & I will use the remainder of the morning generating a good range of filters.

Developer:

a log γ ($\gamma = 1.5$) can be obtained by using D 76 at 1 D 76 to 9 H₂O.

July 28, 1975

Using D76 exposure times on the enlargers
are too long ($t \approx 300 \text{ sec}$)

H R P. Developer.

High Res. Plate Developer gives a
high γ and requires constant agitation
but short exposure times can be used.

Process

1. HRP - 5 min constant agitation 68°
2. Wash 30 sec.
3. Fix 5 min
4. Wash 30 sec.
5. Hypo clearing or Pirina Wash. 5 min
6. Wash 3 min or longer.
7. Photo-Flo 15 sec.
8. Dry.

Subject

Instructor's Name

Control of DC filter

The filters are controlled for D max, diameter and gradient.

Density

The maximum density is controlled by exposure time on the enlarger.

Diameter

The diameter for the most part is controlled by magnification, although the peak density and amount of defocusing controls the end size.

Gradient

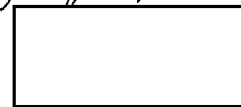
The gradient is controlled by the amount of defocusing when using the enlarger.

Use of the filters with the Beck bench.

One of the generated filters was chosen by John & I for use on the Beck bench to see if

Subject

Instructor's Name



there would be any ringing in the output.
The filters generated by John last week were
hard clip filters compared to the ones we
generated today. The hard clip filter caused
ringing in the system but first results of the
new filters show very little if any ringing.

PM
Beck bend filtering

Object - D.L. resolution target

Filter - A-150

$D \approx 2.06$

diam = 180 mm

Gradient = .41 den/mm

Observation - Sharp edges but an amplitude
inversion is present in the low frequency
bars.  This is caused by

too great a density in the VC filter

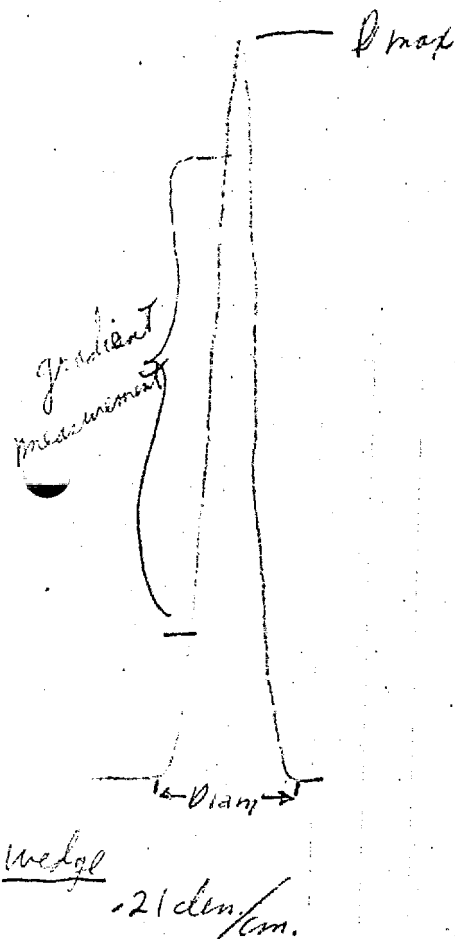
Med. frequency bars tended to have a lot of flare

Subject

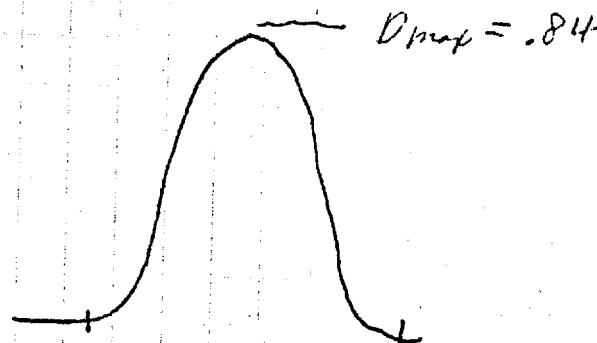
Instructor's Name

A1-150 Filter

microdensitometer Trace.



A1-100 filter



A-1-100 Filter

1. Very distinct edges.
2. Some Amplitude inversion in the low frequencies
3. Flare has now moved to the third group from the second group.
- 4 There tends to be a slight ringing

Subject

Instructor's Name

Results show that high density filters give amplitude inversions. It is therefore recommended that a series of low density filters be tried in the system. First indications with these lighter filters is that good edge information is present and small loss of low frequency information is observed.

John will try different size filters and different gradients to ~~see~~ obtain best results.

Subject

Instructor's Name

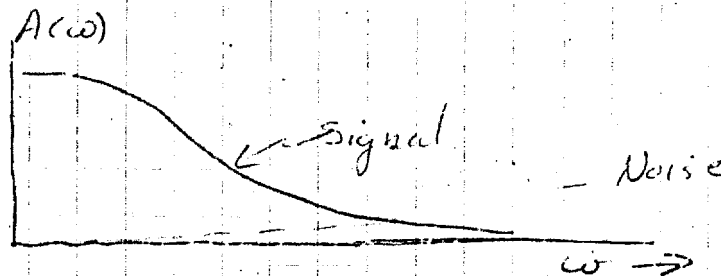
Specification of High Frequency Enhancement Filters

This topic should be resolved to optimize efficiency in fabricating and evaluating filters. What do we need

- 1) Filter must be matched in transmission and dimension to maximize information gain at high frequencies of input imagery.
- 2) The two components (transmission and dimension) are specified by the class of imagery to be processed and the focal length of the processing lens.

e.g.

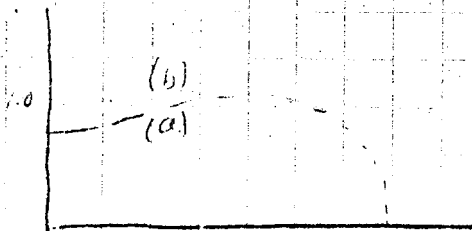
input
image
spectrum



Processing lens
diffraction

$$d = \lambda F \omega$$

Desired enhanced
spectrum



either of form
(a) or (b).

We can form the above premises and test them. They provide a means to determine filter specifications.

Aug 11, 1970

Subject

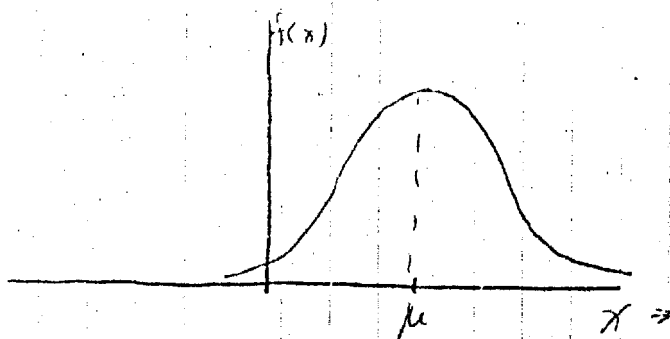
Instructor's Name

Possible filter functions

Normal Distribution (Gaussian)

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2}$$

μ = mean
 σ = st. dev.

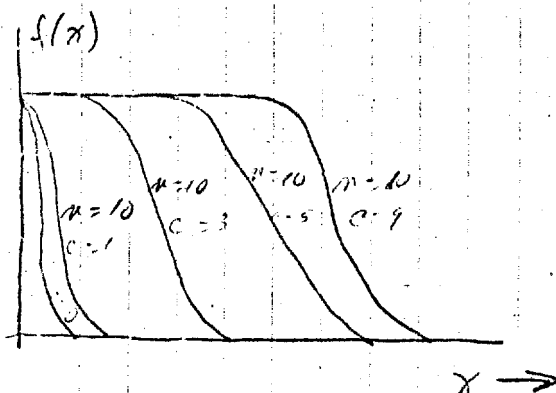


Binomial Distribution (Bernoulli)

$$f(x) = \binom{n}{x} p^x q^{n-x}$$

$$= \frac{n!}{x!(n-x)!} p^x q^{n-x}$$

$\mu = np$
 $\sigma^2 = npq$



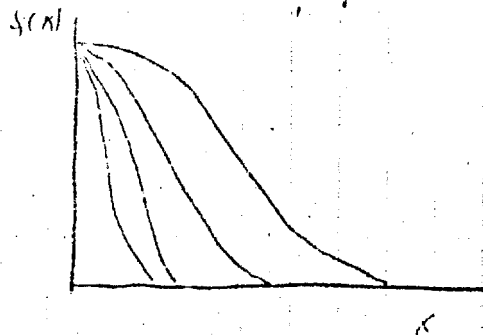
Subject _____

Instructor's Name _____

Poisson Distribution

$$f(x) = \frac{\mu^x}{x!} e^{-\mu}$$

$$\mu = \sigma^2$$



References

Statistics
Rickmers & Todd

Advanced Eng. Math
Kreyszig

We will use a Gaussian form. - took results of TLO work on derivation - best form for general class of imagery.

Initial specifications

@ central peak

@ width for $\approx 90\%$ transmission (amp).

Center spec. $T_A \approx 0.33 \rightarrow 0.7$

$\approx 0.1 \rightarrow 0.5$

$D \approx 1 \rightarrow 0.3$

Width spec

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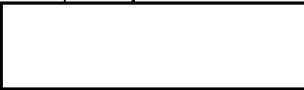
$T_A \approx 0.9$

$T_I \approx 0.81$

$D \approx 0.097 \sim 0.1$

Subject

Instructor's Name



Darkroom preparation of inverse Gaussian filters.

High resolution plates exposed to a soft edged circular function — processed by D-76, 4 parts H₂O to 1 part developer — circular function defocused to yield Gaussian shaped function. These to be tested according to program plan generated on Aug 12, 1970.

- Aug 12, 1970
1. Refer to program plan.
 2. Reviewed status of coherent process.
 3. " " of Beck bench set-up.

the direction of the program as written in the program plan dated 12 Aug.